

segments. Its characters are sufficiently indicated by Champion.

***Milyas spinicollis* Champ.**

This was collected by Professor E. B. Wilson, of Columbia University, in the Grand Cañon of the Colorado along Bright Angel Trail.

***Milyas inermis* Champ.**

Collected by Dr. Henry Skinner and by Mr. C. Schaeffer, of the Brooklyn Museum, in the Huachuca Mts., Arizona, to the former of whom I am indebted for a specimen. This and the preceding species agree in every particular with Champion's descriptions and figures in the *Biologia Centrali-Americana*.

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## NOTES ON BREEDING HEMIPTERA.

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### 1. *Cosmopepla carnifex* Fabr.

During the summer I found a number of Hemipterous nymphs of this species in their last instar feeding on moth mullein (*Verbascum blattaria*). In a few days they matured and proved to be the common *Cosmopepla carnifex* Fabr. The bred specimens and others freshly collected were placed on a moth mullein in a pot covered with a wire screen. The first egg mass was laid on the screen. The youngsters were not able to locate the food plant and soon died. The plant itself did not thrive indoors, so thereafter I supplied freshly picked leaves each day, confining the insects in a pint jar covered with muslin. Eggs were deposited in very irregular masses, 4 to 15 per mass, on any part of the plant which the mothers chose on the upper or under side of the leaf, stem, seed pod or flower bud. In all I secured 69 eggs, but these were deposited by more than one mother. August 20 a batch of eggs was laid on the stem evenly in almost straight lines, two by two. This was rather unusual. They were light apple green, translucent, resembling in nature white grapes, but less oval, more cylindrical, rounding quickly at the ends. The color gradually turned yellowish as the embryo developed and all hatched

August 27. The young lingered two days on the empty egg-shells, then began to feed. August 30 one died, apparently having fallen to the bottom of the jar and being unable to recover its position after landing on its back. August 31 all had their first moult and were much increased in size. They were far more lively and congregated on a green seed-pod which they seemed to prefer to the young shoots and tender leaves. The second moult occurred September 6, ten survivors staying by their seed-pod in a lusty and lively condition. September 11 the third moult occurred. After just emerging from the exuvia the body was light and pale, the thorax, legs and antennæ were very light cream color, but in twenty minutes the antennæ and legs had become entirely black, while the abdomen was greenish with red and yellow markings. The eyes were dark red. The fourth moult occurred September 18 and the first imago appeared September 27. All but one had emerged by September 29, the last delayed until October 1. The period from egg to imago therefore covered 37 to 42 days.

## 2. *Podisus maculiventris* Say.

August 7 I took a pregnant female of this bug. It had lost one hind leg and the last joint of the left antenna so that this organ was rendered useless. Its joints were motionless, each slightly bent away and the whole carried at an awkward angle from the head. The other antenna was in constant motion. Next day 27 eggs were deposited on the jar. Their color was light yellow green with bronzy metallic reflections and with many short black hairs. On the top a row of longer white hairs, curved outward, were set around in a perfect circle. This looked like a spherical cover to the egg, which resembled under the lens some tinsel Christmas-tree ornament. August 9 a mass of 9 and another of 16 eggs were laid. The first batch of young, which hatched August 13, was very light salmon yellow just after emerging. Other batches comprising 27 and 22 eggs were laid. The next day the first born left their shells to hunt for food. The mother had a habit of playing her good antenna over and upon the youngsters, which showed no alarm. On the twenty-first the mother died, presumably of old age, having bequeathed to posterity 8 egg masses of 168 eggs in all. The smallest batch was 9 and the largest 27. The smallest batch and one of 16 were laid the same day and perhaps ought to be regarded as a single mass, making

an average of 24 eggs per mass. A batch of youngsters in a separate jar all died in about a day. This was apparently due to the lack of vegetable food which they needed in the early stages, but possibly the dry soil absorbed the moisture of the air too freely, as the jar was lightly covered. Another jar continued to be well populated with nymphs of all ages. The young thrived partly on vegetable food but were also cannibalistic apparently in all stages. The first imago appeared September 7, making a life cycle of about 30 days, but others continued to appear until the eighteenth. No doubt indoor breeding, with steady temperature and plenty of food, hastened development. A newly matured bug deposited an egg mass on a stem the next day.

The food of this species is mainly if not almost entirely Lepidopterous larvæ. Mr. Franck observed on Staten Island a wholesale mortality of potato beetle larvæ, with abdominal contents sucked out by a bug, probably this species, but he took none home for positive identification. Mr. Dow has observed *Podisus maculiventris* attacking beetles (*Adalia bipunctata* and *Epitragus arundinis*). The beaks were thrust into the soft tissue between the thorax and elytra and the beetles seemed to offer no resistance whatsoever. Mr. Wm. Davis reports this species with a small snout-beetle on its beak. Prof. J. B. Smith mentions a *Podisus* with its beak in the abdomen of a large carpenter ant (*Camponotus*). I have observed *maculiventris* preying upon larvæ of cabbage butterflies, tussock moths, *Alypia octomaculata*, and various noctuids and geometers. In captivity, cannibalism destroyed almost my whole colony. A nymph in the second or third instar attacked a much larger one and almost succeeded in killing it. Another nymph attacked an adult, but the latter escaped by superior mobility. They attack their prey from behind, sometimes stalking their victim for a considerable distance. When in a favorable position they thrust the beak quickly and directly. I have seen them also assail Lepidopterous larvæ at the side of the last abdominal segment. At the first feeling of the beak the caterpillar would sway from its position as rapidly as possible. Master bug took advantage of this method of defence by standing with extended beak and soon the caterpillar would impale itself. Escape by flight was then impossible. I have observed a caterpillar dragging along four nymphs of considerable size. I saw

one nymph attack a very hairy young caterpillar, but the hairs were too long or the beak too short and after a prolonged effort the bug abandoned the attack. I have not observed this bug eating vegetable food while mature or in the last instar; in younger stages, however, I have seen it with its beak in the green stems of evening primrose (*Onagra biennis*) and moth mullein and in the leaves of other plants. One nymph remained four minutes with its beak in a freshly cut stem of evening primrose.

I had an opportunity to observe a pair of *Podisus maculiventris* courting and copulating. The male started off by walking right over to the female. He showed signs of great affection by rubbing his head against her body several times. Then he strode diagonally across her and began to caress her from the other side. After a short time he turned towards her posterior end and lifted her abdomen up by pushing his head under it. Both insects then remained in this position for a short time, the male continually knocking his head up against the female's abdomen and lifting her higher and higher. During this performance the male's penis was protruded and he gave signs of great excitement by expanding and contracting his body and turning almost completely around. When this excitement was at its height, he crawled out to one side, and still keeping part of his body under the female, till he was far enough out to turn sidewise, he inserted his organ in her vagina. The lock was complete and he then turned completely downward so that the two insects were end to end. The male then played his legs on the female's dorsum like a pair of drumsticks. This performance occurred at very frequent intervals in the beginning, then every minute or so, but gradually the movements ceased or were repeated only now and then. The pair remained *in copulâ* all night on the very same spot.